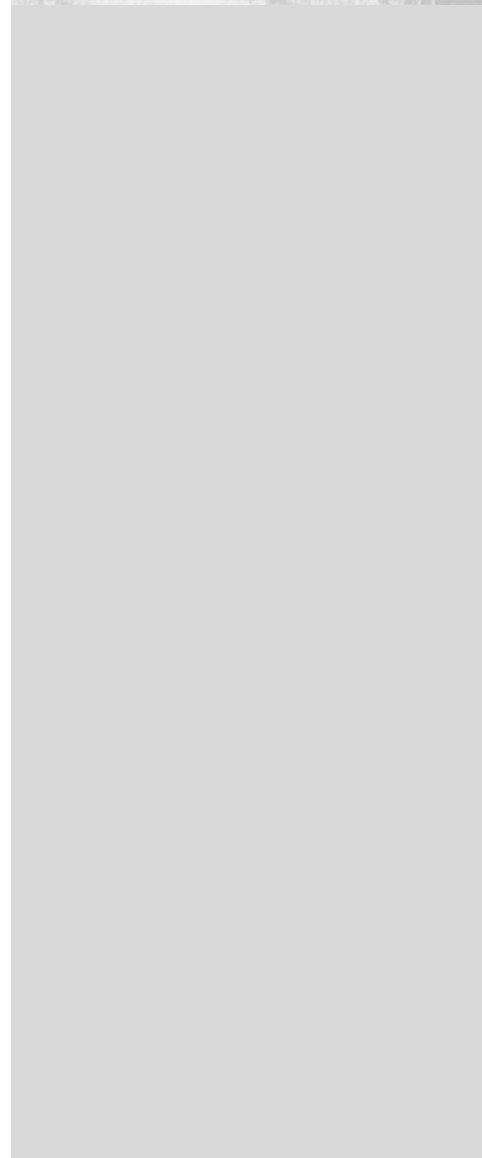


**POSTER
ABSTRACTS**



Overview—A Bird's-Eye View of the Poster Abstracts

John M. Bryant, Technical Chair

Thirty-one posters were displayed during the symposium. These covered a wide range of topics in highly creative and informative ways. Fifteen of these are presented here as extended summary papers, 11 are presented as brief abstracts. Topics are:

Poster Abstracts

Moon Stumpff—A presentation of Native American history and philosophy in relation to methods for reconstructing the ecological past.

Berman and Bledsoe—Studies suggest that forest soil used as inoculum can increase mycorrhizal infection of the roots of valley oak seedlings.

Bledsoe and Millikin—Reports on oak root activity during the summer.

Fong, Bayer, and Schwan—Reports accelerated growth rates of coast live oak and valley oak with tree shelter vs. no shelter.

Matzner, Rice, and Richards—Found no differences in the water relations between blue oaks in regeneration and nonregeneration areas.

Montalvo, Conrad, Conkle, and Hodgskiss—Describes genetic structure, importance of cloning, and the link between the oaks' reproductive ecology and extent of genetic diversity to ensure long-term viability.

Work—Discusses seed source, reduction of annual vegetation, periods of young plant rest, and good seed soil for oak regeneration.

Connor and Joyce—A model plan for management of the hardwood rangeland at the University of California's Sierra Foothill Research and Extension Center.

Narwarth, Quinn, Roberts, and Bihari—Describes a research and restoration program for the California walnut in the Puente and San Jose Hills of eastern Los Angeles County.

Lian—Presents Pacific Gas and Electric Company's vegetation management program.

Lomas, Pillsbury, and Larson—Describes programs of various agencies and organizations to promote protection and conservation of oaks and oak woodlands throughout California.

Kruger and Thompson—A cross-sectional survey of the attitudes, beliefs, and behavior of oak woodland landowners.

Oak Woodlands and Prescribed Burning— An American Indian Perspective

Linda Moon Stumpff¹

This poster provided historic and archeological evidence of Chumash management in oak woodlands. It presented cultural and scientific methods for reconstructing the ecological past. Cultural ecology, cultural materials, and the significance of oaks in Indian culture today were shown:

- Prescribed burning and basketry materials
- Oaks and culture
- Interpreting oak woodlands

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Effect of Forest Soil Inoculum on Mycorrhizal Root Development and Growth of Valley Oak Seedlings

Jennifer Berman¹ Caroline Bledsoe¹

Ectomycorrhizae are an almost ubiquitous occurrence on trees and are known to improve the growth and nutrition of many species of tree seedlings. Little is known about the importance of ectomycorrhizal infection to the establishment, survival, and growth of California oaks. In this study a field experiment and a greenhouse experiment were carried out to assess the effects of mycorrhizal infection on valley oak (*Quercus lobata* Née) seedling growth. This information could be a valuable aid in efforts to reintroduce valley oaks to disturbed riparian areas.

In the field experiment, valley oak acorns were planted in a cleared agricultural field, where no fungal inoculum was expected to be present. Soil collected from a mature riparian valley oak forest containing abundant potential fungal inoculum was put in acorn-planting holes. Two additional treatments, one using the local agricultural field soil and one using pasteurized forest soil, were set up as controls. Six months later there were no significant differences in survival and stem height among the treatments. When seedlings were harvested 10 months later, mycorrhizal roots were found on all the treatments, though with significantly greater infection in the unpasteurized forest soil treatment than in the agricultural soil and the pasteurized forest soil treatments. Preliminary analysis shows no significant differences in root biomass among the treatments.

In a greenhouse experiment, acorns were planted in riparian forest soil, agricultural field soil, and pasteurized forest and agricultural field soils. After 6 months there were no significant differences in stem height between treatments. After 1 year mycorrhizal infection in the seedlings in the unpasteurized forest soil treatment was greater than the infection in the agricultural and pasteurized soil treatments.

These studies suggest that forest soil used as inoculum can increase percent mycorrhizal infection on valley oak seedling roots. The effect of mycorrhizal infection on growth should be evaluated in a longer-term study.

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Soil Water Potentials Provide Evidence of Hydraulic Lift and Oak Root Activity in a California Blue Oak Woodland

Caroline S. Bledsoe¹ Catherine S. Millikin¹

Blue oaks (*Quercus douglasii*) and annual grasses coexist in an environment that appears to be unfavorable toward growth during hot dry summers. To see how the dry summer affects root activity, soil water potential was measured with thermocouple psychrometers at four depths (25, 50, 75, and 100 cm). Values remained relatively high (>0.3 MPa) until late May, when soil water potential began to drop. Lowest water potentials occurred in early October, reaching mean values of -5.7, -4.7, -3.6, and -4.3 MPa for 25, 50, 75, and 100 cm, respectively.

Because root uptake decreases soil water potential below 25 cm (evaporation is minimal) and grasses senesce by June, the decreases in soil water potential suggest that oak root activity continues throughout the summer. Plots of hourly soil water potential show patterns characteristic of hydraulic lift (water transport from deep root transpiration and nocturnal water release from shallower roots). After sunrise, soil water potential decreased rapidly, presumably because of root transpiration, and, after sunset, soil water potential gradually increased, presumably because roots release water. These patterns occurred between late May and October, when soils were drier, and were observed throughout the soil profile.

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Effects of Tree Shelters on Growth Rates of Directly Seeded California Oaks

Herb Fong¹ Robin Bayer² Joan Schwan²

In 1984, Stanford University assessed ways to re-establish populations of native oaks (*Quercus agrifolia*, *Q. douglasii*, *Q. lobata*) on rural land near central campus. Consultants designed a regeneration strategy, and a local ecology organization implemented a planting and maintenance program. Techniques have been repeatedly adjusted in response to livestock grazing, drought, wildfire, and rodent predation. Since 1991 we have used tree shelters to accelerate growth and protect against predators. *Q. agrifolia* and *Q. lobata* seeded in sheltered sites have shown median growth of two and one-half to three times that of controls seeded in sites without tree shelters.

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Comparisons of Water Stress and Stomatal Conductance in Different Size Classes of *Quercus douglasii* from Different Sites

Steven L. Matzner¹ Kevin J. Rice² James H. Richards¹

Patterns of water stress and its effect on stomatal conductance were determined for different size classes of blue oak (*Quercus douglasii*), a species that is not regenerating throughout much of its range. Predawn xylem water potentials ψ_{pre} and stomatal conductance (g_s) were measured using a pressure chamber and a steady-state porometer. Measurements were made on seedlings, saplings, and adults at three sites that differed in annual precipitation and temperature extremes. Comparisons were also made between adults and seedlings from areas exhibiting regeneration (saplings present) and nonregeneration areas (only adults and seedlings present). Average ψ_{pre} values for adults, saplings, and seedlings, respectively, were -2.1, -2.9, and -3.8 MPa in 1993 and -2.7, -3.8, and -4.8 MPa in 1994. Regeneration and nonregeneration areas did not differ in ψ_{pre} . Diurnal measurements of g_s indicate highest rates in the morning for all size classes with g_s declining after midday. Seedlings had high g_s rates early in the season but declined to only 60 percent for adults by mid-season. Average g_s values for adults and saplings were not different. Comparison of regeneration and nonregeneration areas did not reveal differences in g_s . Although differences between size classes, sites, and years were discovered, there was no evidence that blue oaks in regeneration and nonregeneration areas differ in their water relations.

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Population Structure and Clonal Variation in *Quercus chrysolepis* Liebm.

Arlee M. Montalvo¹ Susan G. Conard¹ M. Thompson Conkle²
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Mature stands of canyon live oak (*Quercus chrysolepis*) are maintained for fire management, habitat for wildlife, recreation, and fuelwood. Basal sprouting is the primary means of reproduction following fire or cutting, and stands frequently include groups of visibly connected trees in a clustered distribution indicative of cloning. Information about genetic structure, importance of cloning, and the link between the oak's reproductive ecology and extent of genetic diversity is important in developing land management policies that will maintain the long-term viability of populations. We determined the extent to which clusters of trees are clonal and defined the spatial pattern and diversity of genotypes for populations in the San Bernardino Mountains in southern California. All sites were within an elevational zone of 1350-1700 m. We mapped more than 100 trees at each of five sites and

genotyped each tree for genetically controlled enzyme variants (allozymes) at seven polymorphic loci (loci with > one allele). We identified clones using the allozyme genotypes and detected an average of 34.4 ± 7.3 (s.d.) clones and 33.4 ± 7.2 genotypes per site. The findings that clustered trees belong to single clones and that most clones consist of few trees were confirmed by the very high spatial autocorrelation of genotypes within 4 m. However, clone size increased significantly with the number of heterozygous loci present in a clone, suggesting that the long-term integration of selection over time favors highly heterozygous clones. Clonal diversity was high relative to reports for most other clonal species; an average of 97 percent of clones had distinct genotypes. Population genetic analyses of 319 clones from six sites revealed high genetic diversity within sites (mean $H_s = 0.443$). Only 1.8 percent of the total genetic diversity was explained by variation among sites (mean $G_{ST} = 0.018$), and we found essentially no substructure among plots within the two sites examined at that level. This indicates that genotypes are essentially randomly distributed within the sample space. Moreover, inbreeding coefficients within sites were generally small and positive, suggesting that little inbreeding occurs. Resulting estimates of gene flow within and among sites were high. These patterns are consistent with studies of other tree species that are highly outcrossing and wind pollinated, such as red oak, Ponderosa pine, and quaking aspen. Despite this, spatial autocorrelation analysis of clones indicated that clones within 4 m of each other tend to be related, possibly because of limited seed dispersal. We recommend that when populations are sampled for genetic structure or gene conservation, collections from single populations should be separated by at least 10 m to minimize duplicate sampling of clones or inclusion of close relatives. We also suggest that elevational zone and microhabitat be carefully matched when transplanting seeds and trees to other locations. This is consistent with seed transfer zone guidelines for coniferous trees. Future studies will examine if there is population structure at the level of different elevational bands or mountain ranges.

Practical Methods of Regenerating Oaks on a Cattle Ranch

George R. Work¹

The cattle ranch is located 15 miles NE of San Miguel, in southern Monterey County, California. Elevation is 1,000-2,200 feet. There are rolling hills and 12-14 inches of rainfall per year.

On our ranch the regeneration of oaks and other native perennial species require four basic things:

- Seed source, preferably from a parent plant on site,
- Reduction of annual vegetation during its growing period (mechanical or chemical most commonly used),
- Periods of rest if defoliation or damage to the young plant occurs ,
- With small seeded perennials it is necessary to provide a good seed soil contact if a duff layer is present. This does not seem to be a problem with the oaks.

The bulk of the oak woodland operators will have to have a financial

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incentive to motivate them and to pay for the costs of any changes that might be needed to regenerate our oak woodlands.

Our experience has shown that, here in California, most all of our native perennials, including the oak, respond and regenerate when the same management principles are applied. This is fortunate because it allows the cattleman to produce more grass to feed his animals while producing perennial grasses and oaks for long-term stability and production.

The seed sources for our regeneration of the oak are usually present in existing trees. It is important to assure a healthy population of scrub jays as they are the planting crew in this regeneration project. Accessible water plays an important role in having jays present. Often water systems are not designed with birds or other wildlife in mind. Existing water troughs can be made more accessible with cement ramps in and out of the troughs. If available, rocks piled inside and outside the trough serve the same purpose. These ramps allow the bird to reach the water regardless of the water level. Another help is using a 0.25- inch coupler nut with a hole drilled through it to make a float ball adjuster so the water level on the trough can be set very close to the edge but still not run over it. Water really belongs on the ground so it is accessible to all the critters in the oak woodlands.

The suppression of the annual vegetation during its growing period, in our area, is done by the rooting of the feral pig. The pig is also a revenue generator. It is harvested through a guided hunting program.

Allowing heavy cattle grazing when the plants are small and the soil is very wet also suppresses the annuals but it is more difficult to achieve.

The necessary periods of rest needed by the oak can be easily accomplished with planned grazing moves. If cattle are given other things to eat, they tend to avoid the seedling oaks and, to a degree, the young saplings until they begin to mature a bit. These periods of rest accomplished with planned grazing will also produce more annual and perennial forage. This will allow the rancher to stay in business and keep the land in trees and grasses.

A Model Nonpoint Source Management Plan For Hardwood Rangeland

J. M. Connor¹ Melissa Joyce¹

The State Water Resources Control Board has adopted and is beginning to implement the California Rangeland Water Quality Management Plan (CRWQMP). This plan was initiated by the state's livestock grazing industry as a proactive means for addressing federal Clean Water Act water quality requirements for California's rangelands. We developed a plan for management of the hardwood rangeland at the University of California Sierra Foothill Research and Extension Center. Its objectives are to guide resource use at the Center and to serve as a practical example for managers of grazing land as they write their own plans as suggested by the CRWQMP. Our planning process is outlined as follows:

- Resource inventory or description. The resources—soils, vegetation types, watersheds, grazing areas, facilities, wildlife, and livestock—

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- and their management were discussed.
- Statement of the goals for resource management and water quality. Production, landscape, and research and education goals were described.
 - Assessment of current conditions. How is current management affecting the resource? Are there any impairments to beneficial uses in local water bodies? Potential nonpoint sources of sediments, nutrients, and pathogens, including those located upstream from the subject property, were noted.
 - Implementation of current management practices that are maintaining and improving water quality and any management changes that are necessary to meet the goals. The nonpoint pollution sources that each management measure addresses were discussed.
 - Monitoring to determine whether the management practices are achieving the stated goals. The plan describes the monitoring methods that will be used.

Restoration of California Walnut Woodlands at the Urban-Wildland Interface in Southern California

Steve Narwath¹ Ronald D. Quinn² James Roberts¹
Gabor Bihari¹

The California walnut (*Juglans californica*) has a very limited range, occurring naturally only in scattered locations between Ventura and San Diego counties. Within that range the most extensive stands are found on north facing slopes in the Puente and San Jose Hills of eastern Los Angeles County. In recent decades much of the walnut woodlands and forests in these hills has been lost to urbanization, and there is no explicit protection of remaining stands. The present landscape includes edges between naturally occurring walnut woodlands and urban, range, and agricultural land uses.

In response to these losses California State Polytechnic University, Pomona, in cooperation with the Los Angeles County Sanitation District, has undertaken a research and restoration program that includes mapping existing walnut stands on and around the campus, monitoring of natural reproduction and growth, and restoration. Since 1990, seeds, and saplings germinated in containers, have been planted on the slopes of a landfill and around the newly established Center for Regenerative Studies. There is some evidence that young trees are more easily established from seeds than from 2-year-old saplings outplanted from containers.

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Pacific Gas and Electric Company's Vegetation Management Program

Heidi E. Lian¹

Urban forestry interface issues influence Pacific Gas and Electric Company every day in its Vegetation Management Program. As more people move into rural areas, where there are more trees there is a greater need for public understanding of vegetation management.

Vegetation Management at PG&E strives to improve safety and reliability of our electric distribution system in compliance with all applicable laws by running an efficient, responsive, and environmentally sensitive vegetation management program. The program is managed by a centralized team with a director, 10 area arborists, six staff members, quality auditors, administrative support, contracted tree pruning companies, and contracted utility forestry consultants.

In 1995 and 1996, PG&E attained the status of a Tree Line USA Utility. PG&E is one of 17 utilities nationwide with this designation. The National Arbor Day Foundation presents this award to utilities whose employees and contractors are trained each year in natural directional tree pruning and tunneling and trenching near trees. The award also requires the company to educate customers about the relationship of trees to utilities and celebrate Arbor Day.

Partnerships are significant in helping to educate every aspect of the communities we serve about line clearance, proper pruning, and planting the right tree in the right place. PG&E works with local governments, environmental groups, schools, homeowners, and other interested parties. By doing this we combine our resources with others to resolve common issues of sustaining a healthy environment, reducing fire potential, increasing public safety, and decreasing maintenance costs.

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Conserve Oak Woodlands

M. Christine Lomas¹ Norman H. Pillsbury¹ Amy Larson²

Oaks (*Quercus* spp.) face a variety of damaging agents such as: fungi, insects, wildlife and humans. Oak woodlands are important for the variety of food they produce (acorns, leaves, bark and resident insects) and the shelter they can provide for wildlife. In recent years, the rise in population and the movement of urban to rural areas have caused a demand for housing and space. This surge in development is causing the eradication of our oak woodlands. Extensive networks of subdivisions, roads, pipelines and transmission lines create a fragmented mosaic of micro-oak habitats that, once isolated, become extinct. Construction sites are not only fragmenting the natural oak woodlands, but causing devastating effects on the natural regeneration of oak seedlings. Agricultural practices are also subject to scrutiny for their field placement and cattle grazing rotations. In fact, grazing now occurs on about 50 percent of

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California's estimated 8 million acres of woodland. The habitat and environment after cattle grazing are so significantly altered that they do not allow for natural oak regeneration.

In hopes of conserving our oak woodlands an effort is being made by several local groups and professional organizations. These include more than 100 municipalities and 38 counties that have established oak tree preservation guidelines and ordinances. Oak reserves have been established by the Bureau of Land Management, the Nature Conservancy, the State of California, the USDA Forest Service, the University of California, and park and water agencies. Organizations such as the California Oak Foundation, established in 1988, promote the statewide protection of oaks and encourage conservation of our oak heritage. The California Oak Foundation's strategy emphasizes the following steps: preservation, habitat restoration, wildland management, urban forestry, and education. With the advancement of communication, the ease in transferring information has permitted various agencies to produce publications, videos, and workshops to provide information to citizens, landowners, and policy makers on how to conserve oaks and oak woodlands.

The Effect of Sociological Factors, Attitudes, and Beliefs on Private Oak Woodland Management¹

Barbara S. Kruger² Richard P. Thompson³

The results of an area weighted cross-sectional survey of landowners attitudes and behaviors are presented. The goal of the study is to first create a descriptive profile of San Luis Obispo County landowner based on socioeconomic characteristics, land use objectives, physical attributes of the property, and their belief that there is an oak resource problem. Secondly, a relationship between this profile and the likelihood that the landowner would manage oaks is established. Finally, the impact of an economic incentive on oak management likelihood is examined.

To collect the data a questionnaire was mailed to 180 landowners. Seventy individuals returned the questionnaire resulting in a response rate of 39 percent. These landowners were randomly selected using an acreage-based sampling system.

The profile of landowners is assembled using descriptive analysis. The relationship between the landowner profile and the likelihood of oak management is established using multiple regression. Finally, the impact of the incentive on oak management likelihood is calculated using descriptive analysis and multivariate analysis.

¹Abstract of a poster paper presented at the Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues, March 19-22, 1996, San Luis Obispo, Calif.

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